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EYE MOVEMENT PATTERNS OF IMPULISVE AND INHIBITED SUBJECTS ON CHROMATIC AND ACHROMATIC RORSCHACH CARDS.

By

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled Eye Movement Patterns of Impulsive and Inhibited Subjects on Chromatic and Achromatic Rorschach Cards, submitted by Bruce Allen Ryan in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

The present study consisted of three phases in which several eye movement variables reflecting general visual activity and location of visual inspection were evaluated as measures of subject reactivity to chromatic stimulus elements. The eye movements of 24 impulsive and 24 inhibited subjects were photographed while they were viewing Rorschach Cards IV and VI (achromatic), II and III (achromatic-chromatic) and VIII and IX (chromatic). The subjects' verbal responses to the cards were also recorded.

In Phase I it was hypothesized, on the basis of Rorschach theory, that impulsive and inhibited subjects should differ in their eye movement patterns if eye movements reflect reactivity to emotional stimulation as Thomas has suggested. Only those hypotheses associated with location of inspection variables were supported. Inhibited subjects spent significantly more time looking at the colored elements of Cards II and III than did impulsive subjects.

In Phase II the same subjects were reassigned to new comparison groups (color and no-color responders) depending on whether or not they mentioned color in their responses to the cards during the performance period. The Phase II analyses tended to replicate those of Phase I. No-color responders spent more time looking at colored areas on Cards II and III than did color responders. Again, no group differences were found in the general visual activity variables.

In Phase III, the subjects were assigned, on the basis of their response protocols, to three groups (impulsive, inhibited, and unclassified) by three clincial psychologists. No differences were found

among the three groups on any of the eye movement variables.

The data appeared to suggest that the location of inspection variables were useful measures of subject reactivity to color stimulation while those reflecting general visual activity were not. The implications of the findings for Rorschach theory and for information processing theory were discussed.

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CHAPTER I

INTRODUCTION

Much of the theory underlying the Rorschach technique postulates that the manner in which a subject handles the color content of a stimulus gives some indication of his typical response to an emotional challenge from his environment (Holt, 1968; Klopfer, Ainsworth, Klopfer and Holt, 1954; Phillips and Smith, 1953; Piotrowski, 1957; Schachtel, 1966; Shapiro, 1960). Indeed, Ainsworth and Klopfer, (1954) have argued that the hypothesized relationship between color and emotion "... is one of the most basic hypotheses of the Rorschach technique (p. 276)." Therefore it is important to show that subjects known to differ in their characteristic response to emotional stimulation will also react differently to color on the Rorschach cards.

As a derivation from the more general hypothesis outlined above, Klopfer, et al (1954), and Phillips and Smith (1953), among others, have pointed out that impulsive and inhibited subjects should reveal different response patterns to the cards containing color. More specifically, the suggestion has been made that impulsive subjects will give more color responses (especially where Form is less important as a determinant) than would be obtained from inhibited subjects.

In the research literature, considerable attention has been paid to the relationship between the impulsivity-inhibition dimension and reaction to color on the Rorschach but, as usual in Rorschach research, the findings have neither condemned nor clearly

supported the hypothesis. While many explanations have been put forward to account for the disagreement in the literature, it may be argued that one of the important problems lies in the extensive use of the formal Rorschach scoring symbols, which are not clearly objective measures of subject behavior. Perhaps more objective, behavioral measures of subject reactivity to color should be developed and analyzed.

The present study was an attempt to investigate Thomas' (1963b) suggestion that eye movements may offer a useful dependent variable in investigations concerned with the impact of emotional stimuli. More specifically, an attempt was made to explore and evaluate some eye movement variables as measures of the reaction of impulsive and inhibited subjects to chromatic and achromatic elements in Rorschach cards.

CHAPTER 2

REVIEW OF LITERATURE

Although Rorschach developed his technique and suggested several hypotheses, including the color hypothesis, during the years from 1910 to 1920, and in spite of the fact that the technique was introduced into North America during the 1930's and 1940's, serious attempts to empirically investigate the vailidity of the color hypotheses did not appear much before 1950. Studies bearing on the hypothesis were published infrequently from 1950 until the mid 1960's with little interest being shown since.

An examination of the studies which have attempted to clarify the relationship between colored stimuli and an impulsivity-inhibition dimension reveals that they tend to differ both in the independent and dependent variables used. Among the independent variables compared have been epileptics and normals, delinquents and non-delinquents, assaultive and non-assaultive subjects, as well as others. Some of the problems arising from the use of many of these comparison groups are discussed below.

Compared to the variation in independent variables used in these studies, the dependent variables, i.e., those providing a measure of subject reaction to color or non-color stimulation, employed by investigators has been relatively restricted. Those variables used most freqeuntly have been the formal Rorschach scoring symbols. Less frequently used variables have been galvanic skin response recordings and reaction times.

In the review of literature presented below the implications arising from the use of the various independent and dependent variables are discussed. For heuristic purposes, the studies have been grouped according to the dependent variables employed. Consequently, three major sections appear, beginning with a review of studies involving the use of formal scoring symbols, followed by those using the galvanic skin response and lastly, those based on an investigation of reaction time differences.

The majority of studies have investigated the relationship between the formal scoring categories and impulsive characteristics. That most should be concerned with the formal symbols is not surprising in view of the fact that they are the important variables in the clinical application of the Rorschach technique.

Holtzman (1950) had 46 fraternity members rate themselves and each other on degree of impulsivity and then correlated these ratings with various indices of color responsiveness. He found no consistently signficant effect among the various color indices when they were analyzed individually. Gardner (1951), with a similar design, used ratings by three graduate students who were well acquainted with the ten subjects, and obtained significant relationships between impulsivity ratings and various Rorschach color scores. In Gardner's study, the number of raters was small, of common background and had fewer subjects to rate so that, compared to Holtzman, the degree of error variance was likely much smaller. Under these conditions Gardner was more likely to discover significant differences if they existed.

Schachtel (1951) compared 500 delinquents and an equal number of non-delinquent boys on their production of color responses. Contrary to the expectation that delinquents would display their impulsive characteristics by giving more color dominated responses, the results failed to show any significant differences between the two groups. The Sum C for the delinquents was 435 vs 406 for non-delinquents. Mean Sum C for the delinquents and non-delinquents was .87 and .80, respectively, while mean Sum C for those giving color responses was 1.7 and 1.5, respectively, for delinquents and non-delinquents. Actually, in terms of proportion of subjects giving color responses, the non-delinquents gave more at 54.2% compared to 51.2% by delinquents. These proportions were not significantly different.

Pruyser and Folsom (1955) examined the Rorschach protocols of 136 epileptics and compared the production of color responses (FC, CF, C, Sum C) of this group with the norms for normals published by Beck, Rabin, Thiessen, Molish and Thetford (1950). Instead of the expected finding that epileptics would produce more color responses, chi-square tests showed that epileptics actually produced significantly (beyond the .02 level) fewer color responses than normals.

Finney (1955) compared 78 assaultive with unassaultive hospitalized psychiatric patients on several hypothesized indices of assaultiveness such as FC-, CF-, CF, Sum C, CF/FC, Sum C/M, FM, FM/M, and F-. The assaultive subjects showed significantly more Sum C and CF while all other measures were not significantly

different.

Cerbus and Nichols (1963) reviewed studies in which color responses were compared to membership in clinical groups supposedly characterized by impulsivity. They concluded that "... investigations of epileptics, psychopaths and delinquents commonly thought of as lacking in impulse control, are consistent only to the extent that these clinical groups are not significantly more responsive to color (p. 569)."

La Barba (1965) correlated Rorschach color responses (M: Sum C and FC: CF + C) and the qualitative score on the Porteus Maze Test, another suggested measure of impulsivity. Results obtained from his fifteen hospitalized psychiatric patients (sociopaths, and acute and chronic schizophrenics) showed no significant relationship between the tests. The Spearman rank correlation coefficient for M: Sum C and qualitative score was .12 while a rho of .10 resulted from the FC: CF + C and qualitative score analysis. For an .05 significance level with N = 15, the required coefficient is .43.

Spielberger, Borgman, Becker and Parker (1966), using twenty-seven psychiatric patients diagnosed as manic-depressive, correlated Sum C and C% (along with several non-color variables) with mood ratings. Mood was measured by the Battery of Feeling and Attitude Scales for Clinical Use, a self-rating technique that reflects a mood dimension from extreme depression (low score) to extreme elation (high score). The rank-order correlation of mood rating with Sum C was .45 ($p<.01$) and with C% was .30 ($p<.05$).

Gill (1966), using college students, examined the relationship between delay of response in problem solving and ability to integrate color and form on a modified Rorschach test. A delay group (those who delayed their responses to a specified problem long enough to obtain the correct answer) and a non-delay group were examined on their production of FC, CF, and C responses. Subjects who were unable to delay their response were found to produce signficantly more color dominated responses.

An examination of the above cited studies reveals a balance between significant and non-significant results. Some studies (Finney, 1955; Gardner, 1951; Gill, 1966; Spielberger et al., 1966) support the contention that color responses are related to impulsivity, while others (Holtzman, 1950; La Barba, 1965; Pruyser and Folsom, 1955; Schachtel, 1951) do not.

The non-supportive studies appear to be of two types. Some (Holtzman, 1950 and La Barba, 1965) attempted to obtain specific measures of impulsivity, but collected their data on subjects that do not necessarily form relevant samples (i.e., subjects for whom color-form integration is not expected to present a problem) for adequate tests of the hypothesis. Singh (1965) has pointed out that the frequent occurrence of negative results could be attributed to the use of normal subjects.

The second group of non-significant studies (Cerbus and Nichols, 1963; Pruyser and Folsom, 1955; Schachtel, 1951) attempted to gain more relevant samples by choosing groups such as delinquents and

epileptics, which are supposedly noted for exhibiting impulsive behavior. Such classifications, however, are complex and typically encompass a large number of different personality characteristics in various combinations. It is quite possible, therefore, that many delinquents, for example, would not possess the more specific personality characteristic of impulsivity. Consequently, using the global category of delinquency may be considered inappropriate for examining the relationship between impulsivity and color responsiveness. Because the Rorschach scoring symbols are hypothesized to be related to particular personality characteristics it would seem more reasonable to chooose subjects on the basis of those characteristics rather than on the basis of the membership in a broad clinical group.

Whether or not specific personality characteristics such as impulsivity are part of larger systems of personality characteristics such as delinquency or psychoneurosis is not entirely a problem for Rorschach theory. The more immediate problem for the projective technique is whether the scoring symbols validly signify the presence of specific personality traits. By comparing one broad nosological category with another, the more specific questions arising from the Rorschach hypotheses cannot be adequately answered.

The studies providing support for the hypothesis, on the other hand, tended to make use of highly relevant, specifically defined and fairly objective measures of impulsivity (e.g., assaultive vs non-assaultive, delay vs non-dealy), as was the case in the Finney (1955), Gill (1966), and Spielberger et al. (1966) studies. As

Ainsworth (1954) noted, "... great care should be taken, in selecting an outside criterion against which to test an hypothesis, to be sure that one is chosen and formulated so as to provide a relevant basis for the test (p. 427)."

Two decades ago Levy (1950) pointed out that little had been done to validate the Rorschach color hypothesis in terms of non-clinical variables. Since that time several studies have appeared which reflect two lines of research, one involving the galvanic skin response and the other, reaction time.

The first group of studies was based on the assumption that if color evokes an emotional response in the subject, this response should be apparent in a galvanic skin response recording. To test this hypothesis, Levy (1950) recorded galvanic skin responses of fifty college students while they viewed each of the Rorschach cards. She found no significant differences between chromatic and achromatic cards in their tendency to influence galvanic skin response readings. Goodman (1950), recording the galvanic skin responses' of 50 psycho-neurotic subjects, obtained similar results. More recently, Brodsky, Brewer, Vrana and Wergin (1969), in a study primarily designed to relate response content to arousal, showed 38 normals, 20 neurotics, and 20 schizophrenics the Rorschach cards while taking galvanic skin response readings. In the normal subjects, the color cards were not associated with higher galvanic skin response readings while the same cards appeared to elicit increased arousal reactions in neurotics and schizophrenics. No statistical test was made for this

observation, however, and an inspection of the data provided shows that the effect of color on galvanic skin response readings in the neurotics and schizophrenics was not strong.

All of the studies using galvanic skin response cited above are open to the criticism that the subjects chosen for testing were not particularly relevant to the hypothesis under consideration. While the samples used by Goodman (1950) and Brodsky et al. (1969) may be considered an improvement over Levy's (1950) in this regard, the general categories of schizophrenia and psychoneurosis are too broad and contain too wide a range of personality characteristics to provide a powerful enough test of the hypothesis.

The second line of research has involved the use of reaction time as a measure of emotional disturbance due to color stimulation (Colon, 1965; Drechsler, 1960; Singh, 1965). All three authors followed approximately the same procedure except for alterations in the comparison groups. Drechsler (1960) specifically set out to evaluate the hypothesis that "... colored stimuli elicit more emotional responses than do gray stimuli (p. 323)." Heeding Siipola's (1950) suggestion that when color is embedded in a complex stimulus (such as a Rorscach card) it becomes difficult to assign responsibility for evidence of psychological disruption (e.g., lengthened reaction times), Drechsler chose to present the colored stimuli by projecting rectangles of homogeneous color onto a screen in front of the subjects. While the color was being presented, a word association test was given and reaction time was used as the measure

of disturbance. Analysis of results showed that lengthened reaction time was associated with the presentation of colored light as opposed to gray. Drechsler interpreted this as demonstrating that color has an emotionally disturbing effect.

It may be argued, however, that color presented in the above fashion is not related to the way in which a person taking the Rorschach encounters color. In the Rorschach the color is an integral part of the problem of integrating the complex stimulus into a meaningful percept. In the case of Drechsler's design, the color is presented in competition with another task, the solution of which can in no way involve the incorporation of color. Instead of creating a perceptual problem similar to the Rorschach, Drechsler may have been dealing with a situation which could be interpreted more efficiently in terms of attentional proccesses. Perhaps his findings point out that red and green are more demanding of attention than gray and are more capable of distracting the subject's attention from an unrelated and competing stimulus complex.

Singh (1965) attempted to replicate Drechsler's study and compared reaction time to color shock on the Rorschach. No significant results were obtained. Colon (1965) compared three groups: normals, impulsives, and inhibiteds (defined by the Minnesota Multiphasic Personality Inventory) in their reaction times on Drechsler's tasks. Again the color did not differentially affect the three groups.

While the findings of the above studies are essentially negative, it may also be argued that Rorschach's theory was not being

tested.

In general, this survey of the literature has shown that where an effort has been made to adopt fairly well defined criteria and where the dependent variables have been meaningfully related to the color hypothesis, investigators have tended to support the contention that color response is related to impulsivity. This relationship, however, has only been demonstrated in studies using Rorschach scoring symbols. While there is little doubt that the Rorschach symbols are frought with psychometric problems, such as weaknesses in reliability and a limited range of scores among subjects, it is likely that such problems would lead to the occurrence of non-siginificant findings. Therefore significant findings would tend to occur less often than might be expected on the basis of any real differences among samples. This factor only tends to enhance the impression of the significant findings that have been cited above.

There is, however, another characteristic of the Rorschach scores that may have implications for these same significant findings. The formal scoring categories are only abstracted summaries of the subject's verbal behavior; consequently, they reflect, in part, the judgment of the scorer who is generally inclined to support or not support the hypothesis.

Levy and Orr (1958), in a survey of 168 Rorschach validity studies over a five year period, found that research outcomes were significantly related to the affiliation (academic or non-academic) of the investigator. They pointed out that some persons "... consistently report either positive or negative findings

with regard to the Rorschach (p. 82)." The implication is that experimenter bias may have a significant effect which leaves one facing the possibility, as Sherman (1960) noted, that it may be necessary "... to look for validation of the psychologist himself rather than Rorschach (p. 176)." Clearly, in order to overcome the possible source of experimenter bias associated with the formal scoring procedures, a more objective behavioral dependent variable should be selected for analysis. The attempts by investigators to use galvanic skin response recordings and reaction times, while interesting and not inconsistent with the position advanced in the present study, are weak methodologically and do not adequately test the Rorschach color hypothesis.

A yet to be researched approach to Rorschach validation, which avoids many of the problems outlined above, has been suggested by Thomas (1963b). He argued that an important factor in the mechanisms controlling a person's eye movements is the emotional meaning that a stimulus has for the subject. Consequently, eye movements "... may offer a vector measurement of the emotional content of a visual display (Thomas 1963b, p. 346)."

It is possible, therefore, that eye movement data may provide a useful means for investigating the relationship between colored stimuli and the impulsivity-inhibition dimension. As objective measures of subject behavior, eye movements appear to possess several possible advantages over the frequently used Rorschach scores. For example, Thomas (1963a) has pointed out that subjects are largely unaware of their own eye movements made when deriving and processing information.

Consequently, the probability that the testee can consciously censor any of his significant reactions to stimuli is reduced. Thus, eye movement data may more accurately reflect the subject's response to color stimulation than the verbal report which serves as the primary basis for clinical interpretation.

Furthermore, because the eye movement data is analyzed directly, there is no loss of information caused by a summarizing process like that associated with standard Rorschach scoring procedures. Finally, eye movements are objective behavioral measures, and are therefore less likely to be influenced by the experimenter.

The present study was an attempt to investigate Thomas' (1963b) suggestion that eye movements may offer a method for measuring a subject's reactivity to emotional stimulation. The study consisted of three phases in which various groups expected to differ in their handling of chromatic stimuli were compared for differences in eye movements recorded while they were viewing Rorschach cards. In the first phase, impulsive and inhibited subjects, who were chosen on the basis of an objective personality questionnaire, were compared for eye movement differences. In the second phase subjects who verbalized color content during Rorschach administration were compared in their eye movements to those who did not. Finally, in the third phase, subjects classified as impulsive and inhibited on the basis of their Rorschach protocols were compared for eye movement differences.

CHAPTER 3

RATIONALE, DEFINITIONS and HYPOTHESES

Rationale for Eye Movement Variables

A close examination of available literature failed to reveal any studies investigating the relationship between color and an impulsivity-inhibition dimension in terms of eye movement variables. In fact, only two studies (Blake, 1948; Thomas, 1963b) were found involving eye movements and the Rorschach, and neither of these were intended as tests of any hypotheses. Both were purely descriptive studies in which a group of subjects were shown the Rorschach cards while eye movements were photographed. In each the experimenters described eye movements in terms of numbers, durations, and locations of fixations.

In view of the paucity of previous relevant research some consideration was given to the questions that appeared to be important in a study such as the present one. Would impulsive and inhibited subjects differ in the level of visual activity revealed under varying amounts of color stimulation? Would they rapidly shift their gaze across the surface of the blot, inspecting many different areas or would they examine detail in a more deliberate fashion? When they shifted their gaze, would they do so only in small jumps or in extensive visual sweeps, going from one side of the blot to the other? If given a choice of looking at a chromatic or achromatic element, as in Cards II and III, which would they examine, how often and for how long?

After consideration of a number of questions, such as those

cited above, several specific eye movement variables were developed. The variables, which are defined below, appear to be of two types. The first three (number of fixations, mean track length, and number of shifts) may be considered measures of general visual activity. Whereas the last three (number of frames on chromatic elements, number of runs on chromatic elements, and mean length of run), provide information on the locations looked at when given a choice of looking at chromatic or achromatic elements. These variables are referred to as general visual activity and location of inspection variables, respectively.

Definition of Eye Movement Variables

General Visual Activity Variables

Number of fixations - the total number of fixations, each of which was defined as one or more successive corneal reflections within a circular area 11.4 mm in diameter at a viewing distance of 24". A new fixation was initiated when the corneally reflected spot had shown a shift of at least 5.7 mm (an amount representing a reasonable margin of recording error on the apparatus).

Mean track length - the mean distance in mm between successive fixations.

Number of shifts (Cards II and III only) - the total number of times the subjects shifted their gaze from one labeled blot area to another (See Figure 2).

Location of Inspection Variables

Number of frames on chromatic elements (Cards II and III only) - the total number of frames in which the corneally reflected spot fell on a chromatic stimulus element.

Number of runs on chromatic elements (Cards II and III only) - the number of times a colored area was looked at.

Mean length of run (Cards II and III only) - the mean number of frames per run.

Phases of the Study

Because of the lack of previous research involving eye movements in the context of the color hypothesis, the present study was intended to be exploratory in nature. An attempt was made to evaluate the six eye movement variables by contrasting the eye movement characteristics of different pairs of comparison groups.

The choice of the comparison groups, which reflected aspects of the impulsivity-inhibition dimension, was based on two fundamentally different approaches to subject selection. It was expected that impulsive and inhibited subjects, when chosen on the basis of an objective measure such as the Minnesota Multiphasic Personality Inventory, would differ in their eye movement patterns under color stimulation. Such analysis was carried out in the study's initial stage which was denoted as Phase I.

In addition to comparing groups selected on data independent of Rorschach responses, it also appeared meaningful to attempt some investigation of the relationship between the subject's verbal

reports to the Rorschach cards and his eye movements photographed during the viewing period. In remaining within the context of the color hypothesis, two alternative approaches to examining the verbal report-eye movement relationship seemed useful. The first of these was based on the subjects' tendencies to spontaneously mention color in their verbal reports after their initial exposure to the cards, i.e., during the performance period. Subjects were assigned to two groups, one of which contained those naming or referring specifically to color and the other containing those who made no overt mention of color. Such groups, which differ in the verbal expression of color content, might also be expected to exhibit differential eye movement patterns. The second stage of the study, denoted as Phase II, was designed to examine such an hypothesis.

The second method of constructing comparison groups based on the verbal reports of subjects, involved having trained clinicians interpret the Rorschach protocols obtained during the eye movement recording procedure and assign subjects to impulsive, inhibited or unclassified groups. Such a procedure would be somewhat analagous to standard Rorschach interpretation and would be more conceptually equivalent to Phase I where subjects were also assigned to groups on the basis of their impulsive and inhibited characteristics, than was the case with Phase II. Subjects classified on the basis of protocol analysis could be expected to exhibit different eye movements on the same basis as the groups used in Phase I. The comparison of clinically defined impulsive and inhibited groups for

eye movement differences constituted the third stage of the study and was denoted as Phase III.

While the task of interpreting Rorschach protocols in Phase III of the study was identical to that in the standard Rorschach technique, it should be noted that the nature of the information available to the clinicians was obtained in a manner not typical of the Rorschach method. To obtain valid eye movement recordings several restrictions that do not usually occur in projective techniques had to be placed on the subjects. Several differences might readily be noted. The subjects had no opportunity to touch or turn the cards. Reaction times were under the control of the experimenter, each subject being required to examine the cards for a minimum of 12 seconds before responding. The general nature of the experimental situation was one of careful control in which the subject was asked to remain as still as possible during eye movement recording. One very possible result of restricting subject spontaneity was to reduce the number of "impulsive" signs in the protocols.

Definitions of Comparison Groups

As outlined above, the present study consisted of three phases. Because the same six eye movement variables were analyzed in each of the three stages, the essential distinction among Phases I, II, and III lies in the nature of the comparison groups used.

Phase I

Impulsive subjects - were operationally defined by the Hypomania (Ma) scale from the Minnesota Multiphasic Personality

Inventory. Such subjects are generally enthusiastic, talkative, overactive, emotionally excitable, often irritable and given to frequent temper outbursts (Dahlstrom and Welsh, 1960).

Inhibited subjects - were operationally defined by the Neurotic Overcontrol (No) scale from the Minnesota Multiphasic Personality Inventory and given in Dahlstrom and Welsh (1960). A high score on these items suggests a personality that is tense, tightly controlled and constricted in emotional expression. In general there is an absence of overt reactivity to emotional stimulation.

Phase II

Color responders - were defined as those subjects who mentioned color in the performance period.

No-color responders - were defined as those subjects who did not mention color in the performance period.

Phase III

Impulsive subjects - were defined as those subjects classified as impulsive by clinical interpretation of protocols by trained psychologists.

Inhibited subjects - were defined as those subjects classified as inhibited by clinical interpretation of protocols by trained psychologists.

Hypotheses

Hypothesis 1 (Phase I)

If eye movements offer a useful measure of emotional reactivity

to stimuli as Thomas (1963b) has suggested, then impulsive and inhibited subjects defined with the Minnesota Multiphasic Personality Inventory should reveal different eye movement patterns in the presence of Rorschach stimuli.

Hypothesis 1.1 There will be significant differences in the number of fixations between impulsive and inhibited subjects.

Hypothesis 1.2 There will be significant differences in mean track length between impulsive and inhibited subjects.

Hypothesis 1.3 There will be significant differences in the number of shifts between impulsive and inhibited subjects.

Hypothesis 1.4 There will be significant differences in the number of frames on color between the impulsive and inhibited subjects.

Hypothesis 1.5 There will be significant differences in the number of runs on chromatic elements between impulsive and inhibited subjects.

Hypothesis 1.6 There will be significant differences in mean length of run between impulsive and inhibited subjects.

Hypothesis 2 (Phase II)

If eye movements reflect the manner in which a subject handles the color content of Rorschach cards, then those who give color responses may be expected to differ in their eye movements from those who do not give color responses.

Hypothesis 2.1 There will be significant differences in the number of fixations between color and no-color responders.

Hypothesis 2.2 There will be significant differences in the mean track length between color and no-color responders.

Hypothesis 2.3 There will be a significant differences in the number of shifts between color and no-color responders.

Hypothesis 2.4 There will be a significant differences in the number of frames on color between color and no-color responders.

Hypothesis 2.5 There will be significant differences in the number of runs on chromatic elements between color and no-color responders.

Hypothesis 2.6 There will be significant differences in mean length of run between color and no-color responders.

Hypothesis 3 (Phase III)

If eye movements offer a useful measure of emotional reactivity to stimuli, then impulsive and inhibited subjects (clinically defined) will reveal different eye movements in the presence of Rorschach stimuli.

Hypothesis 3.1 There will be significant differences in the number of fixations between impulsive and inhibited subjects.

Hypothesis 3.2 There will be significant differences in mean track length between impulsive and inhibited subjects.

Hypothesis 3.3 There will be significant differences in the number of shifts between impulsive and inhibited subjects.

Hypothesis 3.4 There will be significant differences in the number of frames on color between impulsive and inhibited subjects.

Hypothesis 3.5 There will be significant differences in the number of runs on color between impulsive and inhibited subjects.

Hypothesis 3.6 There will be significant differences in mean length of run between impulsive and inhibited subjects.

CHAPTER 4

METHOD

Phase I

Subjects

A total of 461 undergraduates in introductory educational psychology classes were given a 75 item test containing the Hypomania, Neurotic Overcontrol and Lie scales of the Minnesota Multiphasic Personality Inventory (Dahlstrom and Welsh, 1960, See Appendix A). The 46 subjects obtaining Lie scores of 6 or more were classified as invalid responders and were deleted from the sample. The remaining subjects were ranked in terms of both their Ma and No scores. To obtain 24 subjects in each personality group, the 24 subjects scoring highest on Ma were classified as impulsive. Similarly, the 24 highest scorers on No were classified as inhibited. No subject was "high" on both lists. The mean scores of the Ma and No scales for the impulsive subjects were 28.21 and 5.71, while for inhibited subjects they were 16.46 and 11.63. The mean age for impulsive subjects was 19.58 and for inhibited subjects, 19.33. The groups contained an equal number of males and females.

Stimulus Cards

Rorschach Cards IV, VI (achromatic), II, III (achromatic-chromatic), VIII, and IX (chromatic) were selected as representative of three types of cards that should be investigated. This choice of cards permitted the comparison of one card type with another as well as comparisons between personality types under varying amounts of color stimulation. Moreover, the use of Cards II and III allowed

the investigation of eye movements pertaining to specific areas looked at when a choice between color and no-color permitted.

Apparatus

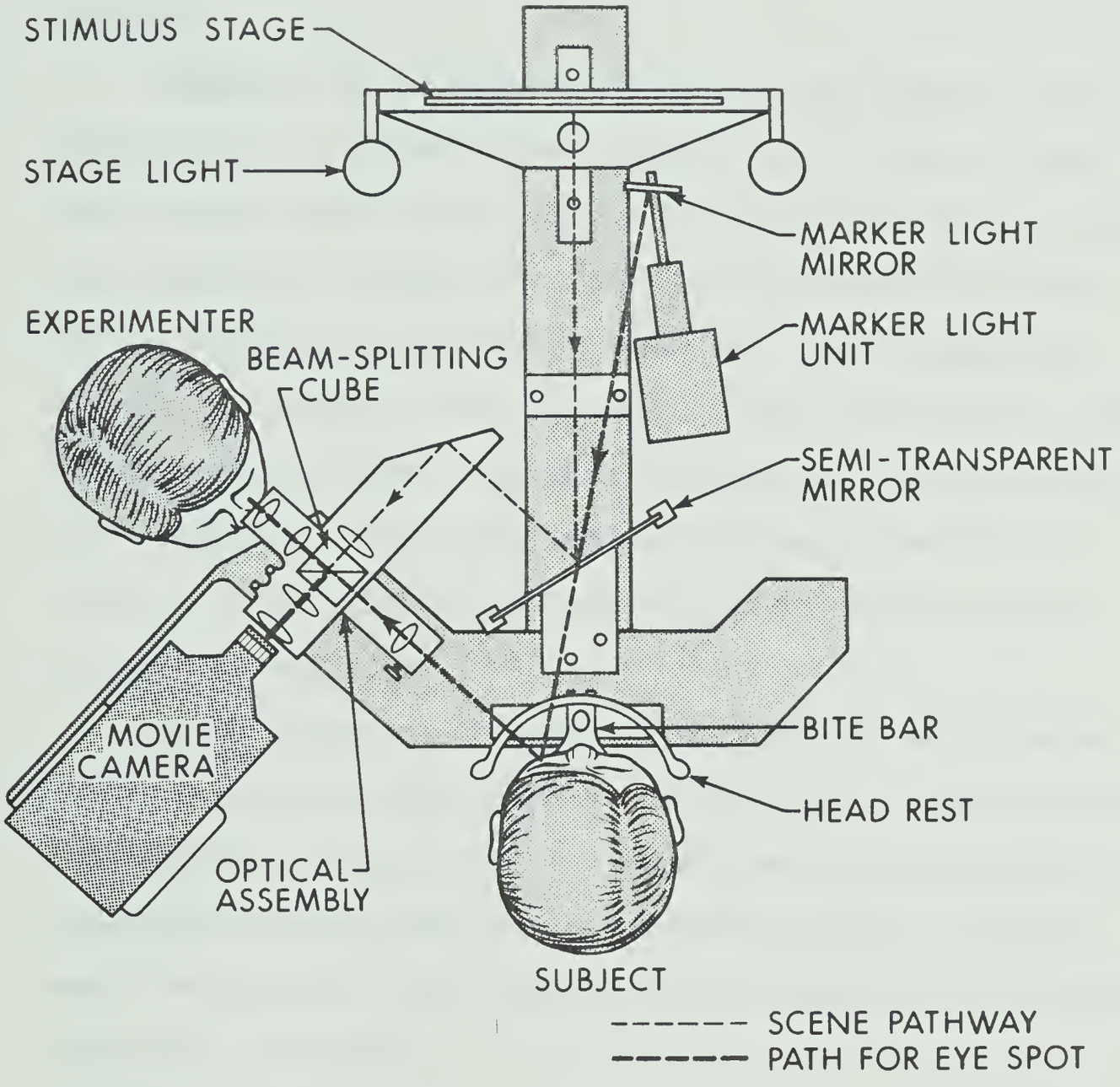
A Polymetrics corneal reflection eye movement recorder Model V-1164 (See Figure 1) was used to obtain permanent photographic records. The recorder used a Pathe "Professional" 16 mm reflex camera which was operated at a constant rate of 10 frames per second. Full technical data may be obtained from Mackworth (1967).

The six Rorschach cards were inserted into the stimulus stage one at a time, and illuminated by two stage lights on either side. The useable viewing area was 7.8 by 7.8 inches so that all blot areas were well within the dimension limits of the stimulus stage.

Each subject was seated in an adjustable padded chair in front of the apparatus so that his eyes were approximately 24 inches from the stimulus stage. A light was reflected off the cornea of his eye and carried to the film via a set of prisms. The image of the corneally reflected light spot was super imposed over an image of the object being observed by the subject so that the reflected spot would indicate the area of the stimulus array being examined.

General Experimental Design

The stimulus materials were presented to the subjects in accordance with Winer's (1962, p. 563) description of the Latin Square design denoted as Plan 10. Under this design the six stimulus cards were fully counterbalanced over presentation periods and partially counterbalanced over presentation orders. The result was a 6 x 6 x 6 x 2 incomplete factorial design for the factors: orders, periods, cards, and personality types (See Appendix B for an outline of the analysis). Both



SCHEMATIC VIEW OF EYE MOVEMENT CAMERA

Figure 1

impulsive and inhibited groups received identical Latin Squares. With this design, the personality type effect, the stimulus cards effect and personality type by cards interactions were unconfounded and testable.

Procedure

Initially, the students were tested with the Minnesota Multiphasic Personality Inventory items in small seminar groups of about 10-15 subjects. The basic nature of the study was not discussed, but the students were promised a full report on the nature of the study once the data had been collected. Almost all students cooperated with the experimenter. After the tests had been scored and the groups selected, subjects were contacted by telephone and requested to come to the laboratory. None of the subjects declined to come although a few had to be contacted a second time when they failed to appear at the appointed hour.

At the laboratory, the nature of the equipment and its manner of functioning were briefly described to each subject. Prior to the presentation of stimulus cards, the subjects were instructed in the calibration procedure used to insure recording accuracy. Then they were shown a practice card (Card I) in the apparatus and the following instructions were given:

> I am going to show you some cards something like this one. I want you to look at them and while you are looking I will record your eye movements on the film. I will continue recording for 12 seconds and when I stop the camera I want you to tell me what you saw on the card, or what it looked like, or what it might be.

After each card presentation the subjects' verbal responses were written down as in the standard performance period in the Rorschach technique. Once all cards had been presented, an inquiry for response determinants was carried out. Then, all subjects were tested for red-green color blindness with a set of pseudo-isochromatic plates (American Optical Company). None were classified as color blind.

Dependent Variables and Data Scoring

A detailed description of the dependent variables and how they were scored will clarify some of their underlying characteristics. Both fixation and track length variables were scored on a X-Y plotter which allowed the eye movement films to be projected, frame by frame, onto a fairly coarse, ground glass rear projection screen. The screen may be considered a field in which any particular point can be specified by its X and Y coordinates. During scoring the corneal reflection in each frame was located on the screen and its position specified in the form of voltage readings representing the coordinates. The voltage data was entered directly and automatically onto IBM cards. A computer program was then written to translate this information into fixation and track length data.

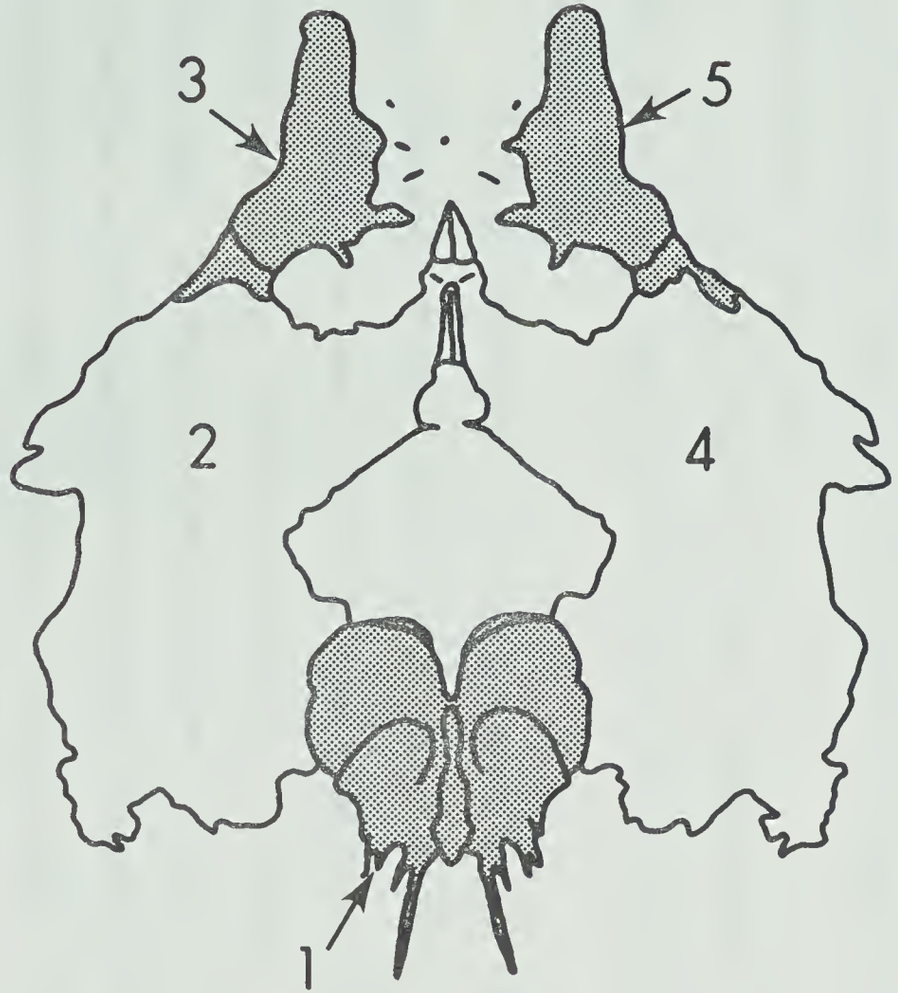
During data scoring, a number of frames were found in which no corneal reflection could be located. Such frames were classified as unscorable and resulted from subjects' eye blinks, glances away from the stimulus materials or from the occasional very rapid eye movement that failed to provide good exposure on film. At times

the latter would appear as a long streak of light and these were always scored at the point closest to the last clear fixation. All unscorable frames were subsequently deleted from the data. Under these conditions 10 scorable frames do not necessarily equal 1 second of recording. The finding that the proportion of unscorable frames was relatively small (983 out of 28,800 scored frames or 3.41%) and that no significant differences were observed between personality types suggest, however, that the number of unscorable frames is not a confounding variable.

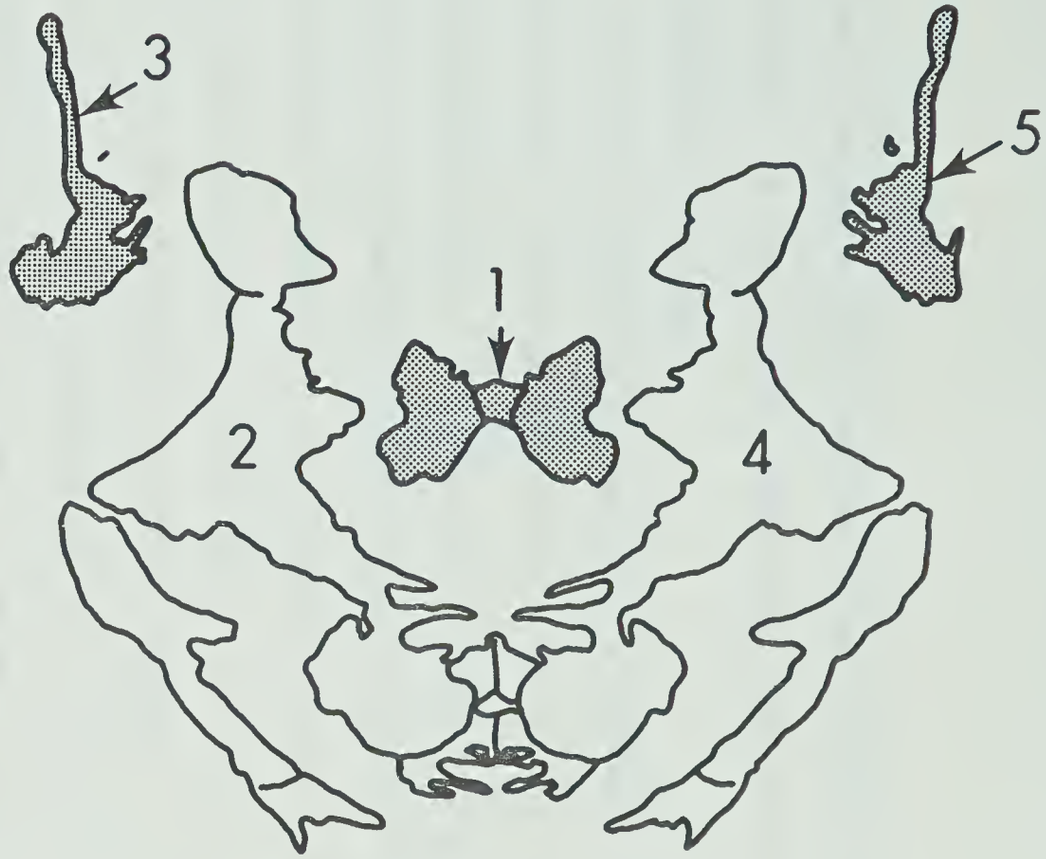
The remaining dependent variables pertain only to Cards II and III, i.e., cards where both chromatic and achromatic elements appear. Various and discrete blot areas were isolated and assigned numerical labels on the basis of their location and chromatic characteristics (See Figure 2). Chromatic areas were given odd number labels while even numbers were assigned to achromatic areas. Space locations and the background areas were considered achromatic areas.

For location scoring, the eye movement films were projected by means of a L-W Photo-Optical Data Analyzer (Model 224-14) onto a small, fine grained rear projection screen. The location of the spot was then determined by visual inspection in each frame and an appropriate label assigned and recorded. The first seven seconds of data were scored in this manner.

Once again a number of unscorable frames were observed, but there were considerably fewer than were obtained when scoring was done on the coarser X-Y plotter screen. The superior projection



CARD II



CARD III

Figure 2

Cards II and III With Achromatic and Chromatic Area Labels

qualities of the more finely grained screen probably accounted for the reduced number of such frames. Here only 78 of 6,720 recorded frames were unscorable, or 1.16%.

To simplify analysis and maintain a constant time base, it was decided to assign number labels to these unscorable frames according to the following rules: (a) when an unscorable frame occurred in the middle of a sequence of fixations on a particular area, the label of that area was assigned to the unscorable frame; (b) when an unscorable frame occurred at a shift point, the label of the area fixated after the unscorable frame was assigned; (c) when two unscorable frames occurred together and at a shift point, one unscorable frame was assigned the label of the area fixated immediately prior to the unscorable frames and the other was assigned the label of the succeedingly fixated area.

The number of unscorable frames assigned colored area labels for the impulsive group was seven while for the inhibited group the total was nine.

From the resulting series of location labels several variables were developed. First, the number of shifts among the variously labeled blot areas was calculated. For example, a subject, when shown Card III, may have begun by looking at one area, then several frames later, shifted his gaze to another area and so on. The number of shifts variable represents the number of times he moved his glance from one labeled area to another. Then the number of frames in which the subjects focused on color (frames on color), and the number of different times colored areas were looked at (runs on color) were

counted. Finally, the mean number of frames per run on color was calculated (mean length of run).

Statistical Procedures

In Phase I, hypotheses 1.1 and 1.2 were tested by the analysis suggested by Winer (1962, p. 563) as appropriate for the Plan 10 Latin Square design. Hypotheses 1.3, 1.4, 1.5, and 1.6 were tested in a 2 x 2 (groups x cards) design with repeated measures on the cards factor (Winer, 1962, p. 302).

Phase II

Subjects

For Phase II the response protocols obtained during Phase I were put in typewritten form, one page per protocol. Each was assigned an identification number that bore no relation to former group membership and no subject names were included on the protocol records.

The protocol for each subject was then inspected for the presence or absence of color as mentioned by the subject during the performance period. Additional information given by the subject during the inquiry period was not included in the Phase II analysis.

Any response that included the name of a color, such as, "It looks like two red balls," or any response that referred directly to chromatic characteristics, such as, "It looks like a brightly colored flower garden" were used to classify the subject as a color responder. The task of assigning the subjects to color or no-color groups was done by two judges independently. Comparison of ratings showed 100% agreement between the two judges.

Twenty-two subjects were classified as color responders while 26 became no-color responders. The new groupings bore little relationship to the original impulsive and inhibited groups. Of the 22 color responders, 13 came from the impulsive group and 9 came from the inhibited group. Of the 26 no-color responders, 11 were in the impulsive group while 15 had been in the inhibited group. A chi-square test of independence showed no statistically significant relationship between Phase I and Phase II group membership ($\chi^2=1.34$; df=1; $.20<p<.30$).

Dependent Variables

The variables analyzed in Phase I were reanalyzed in Phase II.

Statistical Procedures

Because of the restructuring of the groups in Phase II, the Latin Square analysis used in Phase I was no longer appropriate. Consequently, all hypotheses in Phase II were tested in a p x q (groups x cards) design with repeated measures on the cards factor (Winer, 1962, p. 302). More specifically, hypotheses 2.1 and 2.2 were tested in a 2 x 6 design while hypotheses 2.3, 2.4, 2.5, and 2.6 were tested in a 2 x 2 design.

Phase III

Subjects

In Phase III the response protocols were distributed to three clinicians who had been trained in the use the Rorschach, and who had at least three years experience with the technique in a mental hospital setting. Their task was to sort the protocols into three

categories: impulsive, inhibited, and unclassified. The judges were given the description of behaviors to be expected from subjects scoring high on the Hypomania and Neurotic Overcontrol scales (See Chapter 3, p.20) to serve as a guide in assigning subjects to the comparison groups.

Because of the lack of complete agreement among the three judges, it was decided to assign a subject to a particular category if all three judges agreed on the classification, or if two of the three judges assigned him to that category. For 22 of the subjects there was 100% agreement among the judges, while for the remaining 26 subjects two of the three judges agreed. For no subject was there complete disagreement, i.e., no subject was assigned to three different categories. Of the total of 48 subjects, 12 became impulsive, 13 became inhibited, and 23 were in the unclassified category. Winer's (1962, p. 126) repeated measures analysis of variance estimate of reliability for the three judges' combined ratings was .79. In view of the nature of the information which the judges were given, the ratings would appear to be quite reliable.

A comparison of the Phase III groups with the Phase I impulsive and inhibited groups is interesting. Of the 12 Phase III impulsive subjects, 6 were in the original impulsive group and 6 were in the original inhibited group. Of the 13 Phase III inhibited subjects, 2 were in the original impulsive group while 11 were in the original inhibited group. A chi-square test of independence shows that the Phase III groupings were significantly related to those of Phase I ($\chi^2=9.76$; df=2; $p<.01$). The significant chi-square

value appears to have resulted from the similarity between the Phase I and III inhibited groups. Almost all the Phase III inhibited subjects were in the original Phase I inhibited group. In contrast, the Phase I and III impulsive groups reflect no such commonality of subjects.

A chi-square test of independence for the Phase II and III groups showed that the groupings were not signficantly related ($\chi^2=2.80$; df=2; $.20<p<.30$).

Dependent Variables

The variables analyzed in Phase I were reanalyzed in Phase III.

Statistical Procedures

All hypotheses in Phase III were tested in a p x q (groups x cards) design with repeated measures on the cards factor (Winer, 1962, p. 302). Hypotheses 3.1 and 3.2 were tested in a 2 x 6 design while Hypotheses 3.3, 3.4, 3.5, and 3.6 were tested in a 2 x 2 design.

CHAPTER 5

RESULTS

Phase I

General Visual Activity Variables

Hypothesis 1.1, that impulsive and inhibited subjects would exhibit different numbers of fixations over all the stimulus cards, was not supported in any of the seven cumulated blocks of scorable frames. All seven F ratios were well within chance levels and there were no significant interactions between personality types and cards.

The Latin Square design permitted an analysis of order, presentation period, stimulus card, and personality type by card interactions in addition to the personality type effect considered in Hypothesis 1.1. No significant differences in number of fixations were found among the six different orders used. An examination of the six presentation periods revealed significant differences, at the end of 20 and 30 scorable frames (F_{20}=2.37, p=.04; F_{30}=3.38, p=.006; df=5,180). The pattern of differences, however, was highly unstable with the highest number of fixations appearing in the fifth period at 20 frames and in the third at 30 frames.

The analysis of the card effect revealed statistically significant differences among the various cards for number of fixations at the end of 10, 20, and 30 cumulated scorable frames. Table 1 contains the mean number of fixations and F values indicating the significance of the differences among the cards. Throughout, Card III consistently reflected the greatest number of fixations while no single card was associated with the fewest number of fixations. There were no signi-

Table 1

Mean Number of Fixations, F Ratios and Probabilities on Rorschach Cards for First 70 Cumulated Scorable Frames.

Card Type	Achromatic		Achromatic-Chromatic		Chromatic			
Card Number	IV	VI	II	III	VIII	IX		
Cumulated Frames	Mean Number of Fixations						F^a	p
10	3.06	3.54	3.19	4.10	2.29	3.56	4.77	<.01
20	6.40	4.42	6.63	7.73	6.75	7.23	3.65	<.01
30	9.79	10.04	10.08	11.50	10.65	10.65	2.88	.02
40	13.54	13.35	13.81	15.17	13.96	14.21	1.86	.10
50	17.17	16.88	16.88	18.60	17.63	18.00	1.58	.17
60	20.81	20.46	19.83	21.96	20.88	21.35	1.45	.21
70	23.62	23.47	22.87	24.98	23.71	23.94	1.91	.09

[a] df = 5,180

ficant interactions between personality types and cards.

Hypothesis 1.2, that impulsive and inhibited subjects would exhibit significantly different mean track lengths over all stimulus cards was not supported in any of the seven cumulated blocks of scorable frames. All seven F ratios were well within chance levels and there were not significant interactions between personality types and cards.

Again, the order, presentation period, stimulus card and personality type by card interactions were analyzed. As before, no significant order effects were found. The analysis of the presentation period effect revealed no meaningful pattern although a signficant difference occurred at the end of 20 cumulated frames ($F = 2.72$, $p = .02$, $df = 5,180$). The longest track length at 20 frames occurred during the fourth period but this was only 1.79 mm longer than that occurring during the first period which obtained the shortest mean track length.

The analysis of the card effect revealed statistically significant differences among the various cards for mean track length over the entire seven blocks of frames. Table 2 shows the mean track length and F ratios on each of the cards over cumulated blocks of frames. Here, Card III consistently reflected the greatest track length value while Card II consistently obtained the lowest track length value. Again, there were no significant personality type by card interactions.

Hypothesis 1.3, that impulsive and inhibited subjects would

Table 2

Mean Track Length, F Ratios and Probabilities on Rorschach Cards for First 70 Cumulated Scorable Frames

Card Type	Achromatic		Achromatic-Chromatic		Chromatic			
Card Number	IV	VI	II	III	VIII	IX		
Cumulated Frames	Mean Track Length (mm)						F^a	p
10	7.78	8.59	7.04	10.60	7.17	8.35	7.01	<.01
20	8.86	8.05	7.70	10.48	7.89	8.87	7.06	<.01
30	9.25	8.47	8.02	10.72	8.52	8.90	6.34	<.01
40	9.43	8.55	8.41	10.68	8.67	9.01	5.71	<.01
50	9.51	8.70	8.33	10.52	8.68	9.13	5.97	<.01
60	9.65	8.93	8.18	10.29	8.67	9.01	5.88	<.01
70	9.95	9.00	8.09	10.39	8.17	8.99	8.78	<.01

[a] df = 5,180

exhibit different numbers of shifts on Cards II and III, was not supported in any of the seven cumulated blocks of scorable frames. Similarly, all interactions were non-significant.

In summary, the analyses of the general visual activity variables revealed three findings of particular interest for the present study. First, none of the three hypotheses were supported, i.e. there were no personality type differences in any of the three variables. Second, there were no personality type by card interactions. Third, there were no meaningful differences along the achromatic, achromatic-chromatic, chromatic continuum. Instead, Card III consistently reflected the greatest number of fixations and longest track length. No card was repeatedly associated with the fewest fixations while Card II obtained the shortest track length in each block of cumulated frames.

Location of Inspection Variables

Hypothesis 1.4, that there would be significant differences in the number of frames on color between the impulsive and inhibited subjects, was substantially supported. Significant differences between personality types were evident from 30 to 70 cumulated frames. Table 3 contains the mean number of frames on color and F ratios for personality types on each cumulated block of frames. Because no card differences were observed, the table entries are the mean values of the two stimulus cards. Inspection of the table reveals that inhibited subjects tended to spend significantly more time looking at colored areas than did impulsive subjects.

Hypothesis 1.5, that there would be significant differences in the number of runs on chromatic elements between impulsive and inhibited

Table 3

Mean Number of Frames on Color, F Ratios, and Probabilities for Impulsive and Inhibited Subjects on Achromatic-Chromatic Cards

Cumulated frames	Impulsive	Inhibited	F[a]	p
10	2.10	2.57	1.44	.24
20	4.31	5.23	1.93	.17
30	6.11	8.73	8.53	<.01
40	9.34	12.73	7.42	<.01
50	12.34	16.55	8.77	<.01
60	15.13	20.59	10.68	<.01
70	18.19	23.69	9.02	<.01

[a] df = 1,46

subjects, was partially supported. Analysis showed a personality effect after 20 cumulated frames, but no card differences. Table 4 contains these data, again with Cards II and III collapsed. The results, although not quite as strong as in Table 3, revealed that inhibited subjects looked at colored areas more often, especially after 20 frames.

Hypothesis 1.6, that impulsive and inhibited subjects would differ in the mean length of run, was not supported in any of the seven blocks of frames. These data are presented in Table 5 with Cards II and III collapsed. It should be observed, however, that while differences do not reach the .05 significance level, the inhibited subjects consistently had longer runs on color over the range of 70 frames.

Another trend that is evident in Table 5 is the gradual increase in the time spent looking at colored areas for both groups over the entire seven second period. During the first 10 frames, the mean length of run on color was approximately two frames for both groups, and this increased gradually to about five frames by the end of 70 frames. The steadily increasing values in Table 5 were not directly due to a cumulation effect as were the values in the previous tables. Instead, they represent the group means for the average length of run on color for each subject. As such, there was a continuous adjustment for the increase in the number of frames on color and the number of runs on color over time.

Table 4

Mean Number of Runs on Color, F Ratios and Probabilities for Impulsive and Inhibited Subjects on Achromatic-Chromatic Cards

Cumulated Frames	Impulsive	Inhibited	F[a]	p
10	.73	.88	1.65	.21
20	1.32	1.42	1.31	.26
30	1.67	2.19	6.31	.02
40	2.50	2.96	2.76	.10
50	2.98	3.63	4.76	.03
60	3.63	4.29	3.80	.06
70	4.17	4.88	3.51	.07

[a]df = 1,46

Table 5

Mean Length of Runs in Frames, F Ratios and Probabilities for Impulsive and Inhibited Subjects on Achromatic-Chromatic Cards

Cumulated frames	Impulsive	Inhibited	F[a]	p
10	1.83	2.13	.76	.39
20	2.86	2.96	1.25	.27
30	3.33	3.96	1.59	.21
40	3.77	4.48	1.67	.20
50	4.43	4.73	.34	.56
60	4.28	5.00	3.12	.08
70	4.47	5.05	2.36	.13

[a]df = 1,46

In summary, the central finding arising from the analysis of location of inspection variables was that the impulsive and inhibited subjects differed in their reaction to the colored elements in Cards II and III. Basically, the inhibited subjects tended to spend more time looking at colored areas than did the impulsive subjects. The greater number of total frames on color for the inhibited subjects appeared to arise from two interacting sources. First and most important, the inhibited subjects tended to look at color more often, and second, they tended to spend slightly more time on the chromatic areas whenever they did look at them.

Phase II

General Visual Activity Variables

Because of the restructuring of the groups, the Latin Square design used for the analyses of fixations and track length in Phase I was no longer appropriate for Phase II. Rather, a 2 x 6 (Personality types x Cards) design was employed. Consequently, the results of the Phase II analyses of fixations and track length, while substantially the same, are not identical to the results of the Phase I analyses.

Hypothesis 2.1, that color and no-color responders would exhibit different numbers of fixations over all the stimulus cards, was not supported in any of the seven cumulated blocks of scorable frames. All seven F ratios were well within chance levels and there were no significant interactions between personality types and cards.

A comparison of differences in number of fixations among the six stimulus cards revealed results similar to those obtained in Phase I

where Card III repeatedly received the greatest number of fixations but no card was consistently associated with the fewest fixations. The mean number of fixations for each card over the seven blocks of scorable frames were identical to those reported in Phase I (See Table 1).

As before, significant differences were found at 10, 20 and 30 scorable frames ($F_{10}=4.81$; $F_{20}=3.81$; $F_{30}=3.08$; $p<.01$; $df=5,230$).

Hypothesis 2.2, that color and no-color responders would exhibit significantly different mean track lengths over all stimulus cards, was not supported for any of the seven seconds of cumulated blocks of scorable frames. All seven F ratios were well within chance levels, and there were no significant interactions between personality types and cards.

An examination of card differences for track length revealed results similar to those obtained in Phase I with Card III associated with the longest track length and Card II with the shortest. As with fixations, the mean track length on each card for each block of scorable frames was identical to that obtained in Phase I (See Table 2). Again, all differences were significant beyond the .01 level ($F_{10}=8.13$; $F_{20}=6.49$; $F_{30}=5.71$; $F_{40}=5.50$; $F_{50}=6.00$; $F_{60}=5.83$; $F_{70}=8.13$; $p<.01$; $df=5,230$).

Hypothesis 2.3, that color and no-color responders would exhibit different numbers of shifts on Cards II and III, was not supported in any of the seven cumulated blocks of frames. No card differences were found and all interactions were non-significant.

In summary, the analyses of the general visual activity variables

in Phase II provided results substantially the same as those found in Phase I. None of the three hypotheses were confirmed, i.e., there were no personality type differences in any of the three variables. No personality type by card interactions were found and, again, there were no meaningful differences along the achromatic, achromatic-chromatic, chromatic continuum. As in Phase I, Card III was associated with the greatest number of fixations and longest track length while Card II received the shortest track length in each block of 10 cumulated frames. No one card consistently obtained the fewest numbers of fixations.

Location of Inspection Variables

Hypothesis 2.4, that color and no-color responders would differ in the number of frames spent looking at colored elements on Cards II and III, was not clearly supported. Table 6 contains mean number of frames on color obtained by the two groups for each block of 10 cumulated frames. As in the Phase I analyses of location variables no card differences were observed and the table entries are the mean values of the two stimulus cards. While none of the F ratios reached the .05 significance level, no-color responders spent slightly more time looking at colored elements.

Hypothesis 2.5, that color and no-color responders would differ in the number of runs on chromatic elements, was supported only at the end of 30 cumulated frames. Table 7 contains the mean number of runs for the two groups averaged over the two stimulus cards. Again, no significant card differences were evident. An inspection of the mean values shows that no-color responders consistently looked at colored elements more frequently than color responders although the

Table 6

Mean Number of Frames on Color, F Ratios, and Probabilities for Color and No-Color Responders on Achromatic-Chromatic Cards

Cumulated frames	Color	No-Color	F[a]	p
10	2.33	2.33	.001	.97
20	4.15	5.33	2.91	.09
30	6.44	8.25	3.70	.06
40	9.73	12.14	3.42	.07
50	13.27	15.42	1.99	.16
60	16.43	19.06	2.08	.15
70	19.05	22.54	3.23	.08

[a]df = 1,46

Table 7

Mean Number of Runs on Color, F Ratios and Probabilities for Color and No-Color Responders on Achromatic-Chromatic Cards.

Cumulated frames	Color	No-Color	F[a]	p
10	.75	.85	.70	.41
20	1.21	1.43	1.78	.19
30	1.68	2.14	4.58	.04
40	2.51	2.92	2.32	.14
50	3.07	3.50	2.00	.16
60	3.77	4.12	.94	.34
70	4.21	4.74	2.31	.14

[a]df = 1,46

effect was not strong enough to reach statistical significance except at 30 frames.

Hypothesis 2.6, that color and no-color responders would differ in mean length of run, was not supported for any of the seven blocks of frames. All seven F ratios were well within chance levels. Moreover, no pattern similar to that found for number of frames and runs emerged in the results, i.e., neither group consistently obtained a greater mean length of run on colored areas. No card differences were apparent and all interactions were non-significant.

In summary, the analysis of location of inspection variables in Phase II revealed interesting if not strong results. Differences in the number of frames on color were evident with no-color responders spending slightly more time looking at chromatic elements. The tendency for no-color responders to spend slightly more time on colored elements was also reflected in the number of runs on color, but, again, differences were small. No consistent pattern of results emerged for the mean length of run variable.

Phase III

General Visual Activity Variables

Hypothesis 3.1, that there would be significant differences between impulsive and inhibited subjects in their numbers of fixations, was not supported for any of the seven blocks of cumulated frames. All F ratios were well within chance levels, and there were no significant personality type by card interactions.

Analysis of differences in fixations among stimulus cards revealed results substantially the same as those obtained in Phases I, and II. Once more the mean fixation values were identical to those

obtained previously and reported in Table 1. Again significant differences were found at 10, 20, and 30 frames (F_{10}=4.56, p<.01; F_{20}=4.10, p .01; F_{30}=2.81, p =.02; df =5,225.

Hypothesis 3.2, that there would be significant differences in mean track length between impulsive and inhibited subjects, was not supported in any of the seven blocks of frames. All F ratios were well within chance levels, and there were no significant personality type by card interactions.

An examination of differences among cards revealed results in keeping with those of Phases I and II. The mean track lengths on each card were identical to those reported in Table 1 for Phase I. Again all F ratios were significant (F_{10}=6.89; F_{20}=7.04; F_{30}=5.48; F_{40}=5.43; F_{50}=5.81; F_{60}=5.72; F_{70}=7.80; p<.01; df=5,225).

Hypothesis 3.3, that impulsive and inhibited subjects would exhibit different numbers of shifts on Cards II and III, was not supported over any of the seven blocks of frames. No card differences were revealed and all interactions were non-significant.

In summary, the analyses of the general visual activity variables in Phase III provided results in keeping with those found in Phase I and II. None of the three hypotheses were confirmed, i.e., there were no personality type differences for any of the three variables. No personality type by card interactions were found and, as before, there were no meaningful results along the achromatic, achromatic-chromatic, chromatic continuum.

Location of Inspection Variables

No support was found for the hypothesis (3.4) that impulsive and inhibited subjects would differ in the number of frames they

spent looking at color. All F ratios were well within chance levels. Unlike Phases I and II, no meaningful trends were noted in the pattern of mean values over the first 70 scorable frames. No card differences were found and all interactions were non-significant.

Hypothesis 3.5, that significant differences would be found between impulsive and inhibited subjects in the mean number of runs, was also not supported in any of the seven blocks of frames. All F ratios were well within chance levels. Again no meaningful trends were observed, no card differences were noted, and all interactions were non-significant.

Similarly, no support was obtained for the hypothesis (3.6) that impulsive and inhibited subjects would differ in their mean length of run on color. None of the seven F ratios approached the .05 level of significance. As before no meaningful patterns were found in the data, no card differences were observed, and all interactions were non-significant.

In summary, the analyses of the location of inspection variables for Phase III revealed no significant differences between personality types for any of the three variables. Moreover, the tendency for one group to differ consistently did not appear in Phase III as it did in Phase I and II. All difference patterns were highly unstable.

CHAPTER 6

DISCUSSION, CONCLUSIONS AND IMPLICATIONS

Discussion

The discussion of results consists of two major sections. The first section is devoted to an examination of the pattern of support or non-support for the hypotheses over the three phases. The second is a more detailed examination of the results pertaining to the two kinds of eye movement variables investigated: the general visual activity variables and the location of inspection variables.

The Phases

Originally, the comparison groups in the three phases were considered roughly analogous to one another; that is, the color responders and impulsive subjects in Phases II and III were expected to react in a manner similar to the impulsive subjects in Phase I. Similarly, the Phase II no-color responders and the Phase III inhibited subjects were expected to behave like the Phase I inhibited sample. Because it was expected that the respective groups in the different phases would exhibit similar eye movement patterns, it was hypothesized that any differences in eye movements between the comparison groups would be consistent over the three phases.

An examination of the obtained results reveals that the general expectation outlined above was neither completely confirmed nor disconfirmed. With regard to the general visual activity variables, the results were consistent over all three phases in that no significant differences were found between any of the comparison groups. Non-significant results such as these, however, can only be taken as weak evidence that the groups in the phases might be considered

conceptually equivalent.

On the other hand, an inspection of the results for the location of inspection variables revealed that differences obtained between the two groups in Phase I tended to be repeated in Phase II but not in Phase III. The tendency for the Phase I data to be replicated in Phase II suggests that a common basis for assigning subjects to groups may have existed between the first and second phases. The failure to find replication of results in the third phase may indicate that the criteria used for subject assignment in Phase III were substantially different from those used in the first two phases. In other words, the Phase III groups may not be meaningfully equivalent to the groups of Phases I and II. Because the exact basis for classification used in Phase III is relatively obscure, and because no meaningful eye movement data appeared in the third phase, the remainder of the discussion is restricted to the findings of Phases I and II.

Actually, the failure of the Phase I eye movement differences to be replicated in Phase III is interesting in the light of the chi-square tests of independence cited in chapter 4. Those tests revealed a significant relationship between the groupings in Phases I and III but not between I and II or between II and III. Yet, the eye movement differences in Phase I reappeared in Phase II even though the groupings used in the two phases were shown to be independent. On the other hand, the Phase III results are <u>not</u> similar to Phase I even though the groupings <u>were</u> significantly related.

What accounts for the significant degree of relatedness between the Phase I and III groups and why didn't the eye movement data replicate? The significant chi-square value indicating relatedness

appeared to have resulted from the strong tendency for the Phase III judges to classify as inhibited only those subjects who had been inhibited for Phase I. Clearly, the basis used by the judges to indicate inhibition was correlated with that employed by the personality test items. There was little agreement, however, between the test items and the judges in identifying impulsivity. Of the 12 Phase III impulsive subjects, 6 were in the original impulsive group while the remaining 6 had been classified as inhibited. It would appear that there was practically no correlation between the criteria used by the judges to evaluate impulsivity and those employed by the Hypomania scale from the Minnesota Multiphasic Personality Inventory. Therefore while the agreement in classifying inhibited subjects probably accounts for the significant chi-square value, and thus the significant relatedness of the Phase I and III groupings, the failure to find replicated eye movement data likely results from the lack of agreement in assigning subjects to the impulsive groups.

It would appear, then, that the most meaningful results were restricted to Phases I and II. A more detailed description of the relationship between the Phase I and II results appears below in the discussion of the various eye movement variables.

Eye Movement Variables

With respect to eye movement variables two trends were evident in the data over Phases I and II. The variables reflecting general visual activity (fixations, track length, and shifts) did not reveal any significant differences between impulsive and inhibited subjects, nor between color and no-color responders. On the other hand, those variables dealing with location of inspection (number of frames on color, runs on color, and mean length of run) demonstrated group

differences in both phases with the inhibited subjects and no-color responders spending more time looking at colored areas than did their respective comparison groups.

It would appear that an examination of the subjects' general visual activity, as in the first set of variables, is not a very useful procedure within the context of the present problem. What should be noted, however, is that the results of the fixation and track length analyses did not lead to nonsignificant findings, but to findings not meaningful to the Rorschach color hypothesis. The fact that highly significant differences did occur among the cards, particularly with track length, suggests that an effect other than color may be operating. Although the present study does not permit a rigorous examination of the observed card differences, one possible interpretation might be that the structural qualities of the stimuli, rather than the subjects' personality characteristics, were important in determining the fixation, track length and shift variables. Support for this view comes from the fact that Card III, which contains the most well-defined and widely dispersed shapes, was associated with the longest track length and greatest number of fixations. If the variables reflecting general visual activity are highly stimulus specific, as they appear to be in the present study, they may be more appropriate for research where the primary interest is in stimulus properties rather than subject characteristics.

For investigation of differences between people the use of location of inspection variables, such as number of frames on color, runs on color, and mean length of run appears to be more profitable.

Here the analysis showed that inhibited subjects, compared with impulsive subjects, spent more time looking at colored elements mainly as a result of inspecting the colored elements more frequently, but also because they tended to look at the chromatic areas for slightly longer periods of time whenever they did look at them. Similarly, in Phase II, the no-color responders tended to spend more time inspecting the colored areas than did those subjects who mentioned color at least once in their response protocols. Because of the non-significant chi-square test of independence cited above, the replication of results across the phases cannot be satisfactorily attributed to highly similar group composition. Rather, it would appear that there may have been some underlying psychological process that was common to the respective groups in each of the phases and which was reflected in the similar eye movement patterns.

The exact nature of this psychological process remains obscure although the data from the present study do permit some speculation. Such speculation necessitates a reiteration of some of the basic assumptions underlying the Rorschach technique in the context of the color hypothesis. At the outset of the study the proposition that impulsive and inhibited subjects would react differently to color was accepted as tenable. Such acceptance then permitted the evaluation of eye movements as measures sensitive to the differences between impulsive and inhibited subjects in their response to color.

What is the nature of the assumed differences between impulsive and inhibited subjects in the context of Rorschach theory? Basically, the impulsive person is one who reacts rather easily to emotional stimu-

lation (color) and who tends not to integrate very effectively emotional experiences into his reaction to the more objective and formal aspects of his environment. In the Rorschach protocol, this behavior is supposedly reflected in an increased reporting of responses where color is only poorly integrated with form.

In contrast to the impulsive person, the inhibited subject is seen as one who finds it difficult to react easily to the emotional characteristics of his environment and who exhibits a more formal or perhaps intellectual reaction to events. Seemingly there is an active avoidance of giving recognition to emotional experience with the concomitant behavioral characteristics of tenseness, tightness of control, and constriction of emotional expression. Inhibited subjects are generally expected to have difficulty reacting to situations heavily laden with emotional stimulation. In the context of the Rorschach, where color is said to represent the emotional component of a stimulus complex, inhibited subjects are expected to have difficulty reacting to cards containing color. Not only is a marked reduction in a number of color determined responses to be expected but also it is often assumed that the inhibited subject will exhibit "color shock" and be temporarily unable to give any response to cards containing color.

Generally, therefore, it may be stated that the colored aspects of the Rorschach cards may be expected to be relatively more difficult for the inhibited subjects to handle when compared with impulsive subjects. Shapiro (1960) has argued that when subjects cannot readily integrate color and form and where they cannot easily and openly react to color (or emotional) stimulation, then color perception and form

articulation become antagonistic processes. Such is the case with the inhibited subject who, in a sense, has to struggle with the colored elements to integrate them into a predominantly form response or to ignore them altogether. The impulsive subject, who finds it relatively easy to react to color per se rather than trying to respond with color-form integration, will not likely have to "struggle" in the manner of the inhibited subject.

In the context of the present study, it does not seem unreasonable to suppose that a subject would devote increased time to examining a stimulus detail to which he found it difficult to respond. The amount of time spent looking at a given area might, therefore, be taken as an index of the difficulty the subject is having trying to formulate a response involving that area. The results obtained in Phase I are quite consistent with such a view. Inhibited subjects, who were assumed to have difficulty handling colored elements, did spend more time examining colored areas than did impulsive subjects who were expected to react to color easily and with little constraint. In fact, the greater time spent on color for the inhibited subjects appeared to result from their tendency to look at color more often. Such behavior might be interpreted to mean that the subjects were frequently "coming back to reexamine" chromatic areas as if to evaluate their relationship to other aspects of the stimulus material. It is not unlikely that some sort of comparison behavior would be required before the colored areas could be integrated into a well-articulated whole response.

Additional support for the notion that looking time may be a measure of difficulty of responding is obtained from the Phase II

analysis. The expectation here was that subjects who mentioned color in their responses might be expected to find it relatively easy to react to color. Of course, such a classification is very gross and could be, in some cases, misleading. Many subjects give responses that contain no overt mention of color but who nevertheless use color as an important determinant. In spite of this limitation the data do provide some degree of support for the hypothesis that eye movements reflect the difficulty a subject has in reacting to stimulus content. Those who did not mention color tended to spend slightly longer amounts of time looking at colored elements than did those who mentioned color at least once. The pattern of differences was directly analogous to the differences observed between impulsive and inhibited subjects.

One interesting finding, while not of critical importance to the Rorschach color hypothesis, was that all subjects tended to spend more time examining the chromatic areas of Cards II and III as viewing time increased. The shorter runs on the colored elements during the first seconds of recording indicates that subjects probably spent their time examining the larger achromatic shapes before concentrating on chromatic areas. Actually, on Cards II and III the colored areas are mainly peripheral detail with more information being carried by the achromatic areas. This is especially so on Card III. The greater time spent looking at colored elements as viewing time increased may, again, be an indication of the difficulty the subjects had in relating such detail to the over all percept which was likely primarily determined by the achromatic areas. In fact, for Cards II and III the popular responses <u>are</u> mainly suggested by the black areas (Klopfer et al., 1954).

Conclusions

The data from the present study tended to provide some support for Thomas' (1963b) suggestion that eye movements may offer a useful means for measuring a subject's reaction to emotional stimulation. While eye movements reflecting general visual activity failed to discriminate between personality types, those variables indicating the location of the subject's inspection reflected meaningful personality differences. Subjects expected to have difficulty in responding to color (inhibited subjects and no-color responders) spent more time looking at chromatic elements than did subjects hypothesized to have no difficulty responding to color (impulsive subjects and color responders).

More specifically, the data suggest that the location of inspection variables might provide a measure of the difficulty subjects have in extracting information from stimulus details so that those details could become part of a more complex percept. One advantage accruing to such a view is that it avoids the problem of hypothesizing a special relation between eye movements and reactivity to emotional stimulation. Instead, the apparent relationship among eye movements, impulsivity, inhibition and color might be subsumed under a more general theory of information processing. Berlyne (1960, 1965) has pointed out that people seem to attend to those stimuli which create uncertainty or conflict while those stimuli not exhibiting "collative" properties receive only minimal attention. For inhibited subjects, as Shapiro (1960) has pointed out, colored elements present a conflict situation while for impulsive subjects, they do not. According to attention theory then, inhibited subjects should attend to colored areas more than impulsive

subjects. The evidence from the present study is clearly consistent with this prediction.

Implications

The data from the present study revealed that impulsive and inhibited subjects exhibited different eye movements where chromatic stimulus elements were involved. Consequently, the more general Rorschach hypothesis, that impulsive and inhibited subjects would tend to handle color differently was given some degree of confirmation.

The findings of the present study would suggest that eye movement variables such as the location of inspection variables might be useful as a validation method for various kinds of projective techniques involving the use of visually ambiguous stimuli. Within the Rorschach itself, other hypotheses may be amenable to investigation through an analysis of eye movements. For example, it has been suggested (Klopfer, 1954, p. 379) that subjects with sexual problems display a greater amount of interest in sexual body detail. Would eye movement data reflect this tendency? Again, because eye movements are less subject to censorship by the testee, they may offer a better validation method for such a problem than would the subject's verbal report.

Actually, if eye movements were to be used, the investigator would not be required to use the standard Rorschach cards. In fact, it would appear that there may be advantages to using stimuli of less complexity than those involved in the Rorschach. For example, if a replication of the present study were to be attempted, stimuli could be constructed such that the various areas containing color would not overlap as they do on Card II. Not only would such a design permit

increased accuracy of scoring but the experimenter would not be restricted to only a few cards. Rather, the series of stimuli used could be extended at will to deal with the requirements of each specific hypothesis being examined.

References

Ainsworth, M. Problems in validation. In B. Klopfer et al. Developments in Rorschach technique. New York: Harcourt, Brace and World, 1954.

Ainsworth, M. and Klopfer, B. Quantitative analysis. In B. Klopfer et al. Developments in the Rorschach technique. New York: Harcourt, Brace and World, 1954.

Beck, S., Rabin, A., Thiessen, W., Molish, H., and Thetford, W. The normal personality as projected in the Rorschach Test. Journal of Psychology, 1950, 30, 241-298.

Berlyne, D. Conflict, arousal and curiosity. New York: McGraw-Hill, 1960.

Berlyne, D. Structure and direction in thinking. New York: John Wiley, 1965.

Blake, R.R. Ocular activity during administration of the Rorschach test. Journal of Clinical Psychology, 1948, 159-169.

Brodsky, M., Brewer, J., Vrana, M., and Wergin, J., Rorschach content and arousal level. Proceedings of 77th Annual Convention, American Psychological Association, 1969.

Cerbus, G. and Nichols, R.C. Personality variables and response to color. Psychological Bulletin, 1963, 566-575.

Colon, F. A study of response to achromatic and chromatic stimuli. Journal of Consulting Psychology, 1965, 29, 571-576.

Dahlstrom, W.G. and Welsh, G.S. An MMPI handbook: A guide to use in clinical practice and research. Minneapolis: University of Minnesota Press, 1960.

Drechsler, R.J. Affect-stimulating effects of colors. Journal of Abnormal and Social Psychology, 1960, 61, 323-328.

Finney, B.C. Rorschach test correlates of assaultive behavior. Journal of Projective Techniques, 1955, 19, 6-16.

Gardner, R.W. Impulsivity as indicated by Rorschach test factors. Journal of Consulting Psychology, 1951, 15, 464-468.

Gill, H.S. Delay of response and reaction to color on the Rorschach. Journal of Projective Techniques and Personality Assessment, 1966, 30, 545-552.

Goodman, H.W. An experimental investigation of the affect value of color on Rorschach test. American Psychologist, 1950, 5, 321-322. (Abstract).

Holt, R. (Ed.), Rappaport, D., Gill, M., and Schafer, R. Diagnostic psychological testing. New York: International Universities Press, 1968.

Holtzman, W.H. Validation studies of the Rorschach test: Impulsiveness in the normal superior adult. Journal of Clinical Psychology, 1950, 6, 348-351.

Klopfer, B., Ainsworth, M., Klopfer, W., Holt, R. Developments in the Rorschach technique: Technique and Theory. New York: Harcourt, Brace and World, 1954.

Klopfer, W.G. Interpretive hypotheses derived from the analysis of content. In Klopfer et al. Developments in the Rorschach technique. New York: Harcourt, Brace and World, 1954.

La Barba, R.C. Relationship of color responses on the Rorschach to qualitative scores on the Porteus Maze Test. Perceptual and Motor Skills, 1965, 21, 61-62.

Levy, J. Changes in the galvanic skin response accompanying the Rorschach test. Journal of Consulting Psychology, 1950, 14, 128-133.

Levy, J.H. and Orr, T.B. The social psychology of Rorschach validity research. Journal of Abnormal and Social Psychology, 1958, 58, 79-83.

Mackworth, N.H. A stand camera for line-of-sight recording. Perception and Psychophysics 1967, 2, 119-127.

Phillips, L. and Smith, J. Rorschach interpretation: Advanced technique. New York: Grune and Stratton, 1953.

Piotrowski, Z. Perceptanalysis: a fundamentally reworked, expanded, and systematized Rorschach method. New York: Macmillan, 1957.

Pruyser, P.W. and Folsom, A. The Rorschach experience balance in epileptics. Journal of Consulting Psychology, 1955, 19, 112-116.

Schachtel, E.G. Notes on Rorschach tests of 500 juvenile delinquents and a control group of 500 non-delinquent adolsecents. Journal of Projective Techniques, 1951, 15, 144-172.

Schachtel, E.G. Experiential foundations of Rorschach's test. New York: Basic Books, 1966.

Shapiro, D. A perceptual understanding of color response. In M. Rickers-Ovsiankina (Ed.), Rorschach psychology, New York: John Wiley, 1960.

Sherman, M. (Ed.). A Rorschach reader. New York: International Universities Press, 1960.

Siipola, E. The influence of color on reactions to ink blots. Journal of Personality, 1950, 18, 358-382.

Singh, R.K. Effects of color on associational and perceptual functions in reference to Rorschach color shock. Unpublished doctoral dissertation, Boston University, 1965.

Spielberger, C.D., Borgman, R., Becker, J. and Parker, J. Affective expression in manic-depressive reactions. Journal of Nervous and Mental Disease, 1966, 141, 665-669.

Thomas, L.E. Information and eye movements. IBM Medical Symposium, 1963a, 5, 177-197.

Thomas, L.E. Eye movements and fixations during initial viewing of Rorschach cards. Journal of Projective Techniques and Personality Assessment, 1963b, 27, 345-353.

Winer, B.J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

APPENDIX A

The Lie, Hypomania, and Neurotic Over-Control Scale Items from the Minnesota Multiphasic Personality Inventory with Keyed Responses.

Items from the Lie Scale of the Minnesota Multiphasic Personality Inventory with Keyed Responses. (Dahlstrom and Welsh, 1960, p. 458).

15*	Once in a while I think of things too bad to talk about.	F
30.	At times I feel like swearing.	F
45.	I do not always tell the truth.	F
60.	I do not read every editorial in the newspaper every day.	F
75.	I get angry sometimes.	F
90.	Once in a while I put off until tomorrow what I ought to do today.	F
105.	Sometimes when I am not feeling well I am cross.	F
120.	My table manners are not quite as good at home as when I am out in company.	F
135.	If I could get into a movie without paying and be sure I was not seen I would probably do it.	F
150.	I would rather win than lose in a game.	F
165.	I like to know some important people because it makes me feel important.	F
195.	I do not like everyone I know.	F
225.	I gossip a little at times.	F
255.	Sometimes at elections I vote for men about whom I know very little.	F
285.	Once in a while I laugh at a dirty joke.	F

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* Items are numbered as they appear in the Minnesota Multiphasic Personality Inventory test booklet copyrigted 1943.

Items from the Hypomania Scale of the Minnesota Multiphasic Personality Inventory with the Keyed Responses (Dahlstrom and Welsh, 1960, p. 459)

Item		Response
11.*	A person should try to understand his dreams and be guided by or take warning from them.	T
13.	I work under a great deal of tension.	T
21.	At times I have very much wanted to leave home.	T
22.	At times I have fits of laughing and crying that I cannot control	T
59.	I have often had to take orders from someone who did not know as much as I did.	T
64.	I sometimes keep on at a thing until others lose their patience with me.	T
73.	I am an important person.	T
97.	At times I have a strong urge to do something harmful or shocking.	T
100.	I have met problems so full of possibilities that I have been unable to make up my mind about them.	T
101.	I believe women ought to have as much sexual freedom as men.	F
105.	Sometimes when I am not feeling well I am cross.	F
109.	Some people are so bossy that I feel like doing the opposite of what they request, even though I know they are right.	
111.	I have never done anything dangerous for the thrill of it.	F
119.	My speech is the same as always (not faster or slower, or slurring; no hoarseness).	F
120.	My table manners are not quite as good at home as when I am out in company.	F
127.	I know who is responsible for most of my troubles.	T
134.	At times my thoughts have raced ahead faster than I could speak them.	T

143. When I was a child, I belonged to a crowd or gang that tried to stick together through thick and thin. T

148. It makes me impatient to have people ask my advice or otherwise interrupt me when I am working on something important. F

156. I have had periods in which I carried on activities without knowing later what I had been doing. T

157. I feel that I have often been punished without cause. T

166. I am afraid when I look down from a high place. F

167. It wouldn't make me nervous if any members of my family got into trouble with the law. T

171. It makes me uncomfortable to put on a stunt at a party even when others are doing the same thing. F

180. I find it hard to make talk when I meet new people. F

181. When I get bored I like to stir up some excitement. T

194. I have had attacks in which I could not control my movements or speech but in which I knew what was going on around me. T

212. My people treat me more like a child than a grown-up. T

222. It is not hard for me to ask help from my friends even though I cannot return the favor. T

226. Some of my family have habits that bother and annoy me very much. T

228. At times I feel that I can make up my mind with unusually great ease. T

232. I have been inspired to a program of life based on duty which I have since carefully followed. T

233. I have at times stood in the way of people who were trying to do something, not because it amounted to much but because of the principle of the thing. T

238. I have periods of such great restlessness that I cannot sit long in a chair. T

240. I never worry about my looks. T

250. I don't blame anyone for trying to grab everything he can get in this world. T

251.	I have had blank spells in which my activities were interrupted and I did not know what was going on around me.	T
263.	I sweat very easily even on cool days.	T
266.	Once a week or oftener I become very excited.	T
267.	When in a group of people I have trouble thinking of the right things to talk about.	F
268.	Something exciting will almost always pull me out of it when I am feeling low.	T
271.	I do not blame a person for taking advantage of someone who lays himself open to it.	T
277.	At times I have been so entertained by the cleverness of a crook that I have hoped he would get by with it.	T
279.	I drink an unusually large amount of water every day.	T
289.	I am always disgusted with the law when a criminal is freed through the arguments of a smart lawyer.	F
298.	If several people find themselves in trouble, the best thing for them to do is to agree upon a story and stick to it.	T

* Items are numbered as they appear in the Minnesota Multiphasic Personality Inventory test booklet copyrighted, 1943.

Items from the Neurotic Overcontrol Scale of the Minnesota Multiphasic Personality Inventory with the Keyed Responses (Dahlstrom and Welsh, 1960, p. 461).

Item		Response
12.*	I emjoy detective or mystery stories.	F
187.	My hands have not become clumsy or awkward.	F
192.	I have had no difficulty in keeping my balance in walking.	F
228.	At times I feel that I can make up my mind with unusually great ease.	F
229.	I should like to belong to several clubs or lodges.	F
242.	I believe I am no more nervous than most others.	F
267.	When in a group of people I have trouble thinking of the right things to talk about.	T
287.	I have very few fears compared to my friends.	F
292.	I am likely not to speak to people until they speak to me.	T.
353.	I have no dread of going into a room by myself where other people have already gathered and are talking.	F
361.	I am inclined to take things hard.	T
371.	I am not unusually self-conscious.	F
401.	I have no fear of water.	F
440.	I try to remember good stories to pass them on to other people.	F
482.	When in trains, busses, etc., I often talk to strangers.	F
520.	I strongly defend my own opinions as a rule.	F
528.	I blush no more often than others.	F
533.	I am not bothered by a great deal of belching of gas from my stomach.	F

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* Items are numbered as they appear in the Minnesota Multiphasic Personality Inventory test booklet copyrighted 1943.

APPENDIX B

Analysis of Variance for Latin

Square Plan 10 (Winer, 1962, p. 563).

Analysis of Variance for Latin Square

Plan 10 (Winer, 1962, p. 563).

Source of Variation	Degrees of Freedom	E(MS)
Between subjects	npq-1	
C(AB')	p-1	$\sigma_\varepsilon^2 + p\sigma_\pi^2 + npq\sigma_\gamma^2$
D	q-1	$\sigma_\varepsilon^2 + p\sigma_\pi^2 + np^2\sigma_\delta^2$
CD(AB' x D)	(p-1)(q-1)	$\sigma_\varepsilon^2 + p\sigma_\pi^2 + np\sigma_{\gamma\delta}^2$
Subjects within groups	pq(n-1)	$\sigma_\varepsilon^2 + p\sigma_\pi^2$
Within subjects	npq(p-1)	
A	p-1	$\sigma_\varepsilon^2 + npq\sigma_\alpha^2$
B	p-1	$\sigma_\varepsilon^2 + npq\sigma_\beta^2$
AD	(p-1)(q-1)	$\sigma_\varepsilon^2 + np\sigma_{\alpha\delta}^2$
BD	(p-1)(q-1)	$\sigma_\varepsilon^2 + np\sigma_{\beta\delta}^2$
(AB)"	(p-1)(p-2)	$\sigma_\varepsilon^2 + nq\sigma_{\alpha\beta}^2$
(AB)" x D	(p-1)(p-2)(q-1)	$\sigma_\varepsilon^2 + n\sigma_{\alpha\beta\delta}^2$
Error (within)	pq(n-1)(p-1)	σ_ε^2

A - Periods
B - Cards
C - Orders
D - Personality Types

p = 6
q = 6
n = 4